

## WHAT IS CLAIMED IS:

1. A method for manufacturing p-type nitride semiconductor comprising:  
 a semiconductor layer forming process for forming a low resistivity p-type nitride semiconductor layer on a substrate held at a temperature of  
 5 600°C or higher by introducing p-type dopant source, nitrogen source and Group III source on said substrate, and

a cooling process for cooling the substrate bearing said p-type nitride semiconductor layer; wherein

- The hole carrier concentration of said p-type nitride semiconductor  
 10 layer decreases during said cooling process.

2. The method for manufacturing p-type nitride semiconductor recited in claim 1, wherein the decrease (rate) of said hole carrier concentration is 0% - 95% <sup>100%</sup> <sub>time</sub> <sup>100%</sup> <sub>time</sub>

3. The method for manufacturing p-type nitride semiconductor recited in  
 15 claim 1 or claim 2, wherein said cooling process contains a procedure during which the substrate is cooled from the substrate temperature in said semiconductor layer forming process to 600°C within 30 min.

4. The method for manufacturing p-type nitride semiconductor recited in  
 20 claim 1, 2 or (3), wherein the atmosphere in said semiconductor layer forming process contains hydrogen for 5% - 70% in (capacity) percent.

5. The method for manufacturing p-type nitride semiconductor recited in claim 1, 2, or 3, wherein the atmosphere introduced during a procedure, in said cooling process, for cooling a substrate from substrate temperature in said semiconductor layer forming process to 600°C contains hydrogen for 0% -  
 25 50% in capacity percent.

6. The method for manufacturing p-type nitride semiconductor recited in claim 1, 2, or (3), wherein the (atmosphere introduced during a procedure), in said cooling process, for cooling a substrate from said substrate temperature in said semiconductor layer forming process to 600°C contains ammonia, NH<sub>3</sub>.

- 30 ~ 7. A method for manufacturing p-type nitride semiconductor comprising:

30 (can maintain the low resistivity) property.

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10. The method for manufacturing p-type nitride semiconductor recited in claim 9, wherein

the combination of said hydrogen concentration in atmosphere and said cooling rate falls within a region specified by points O - P - Q - R - S - T, in an X - Y coordinate, X axis representing said hydrogen concentration (%) in atmosphere, Y axis representing said cooling rate ( $^{\circ}\text{C}/\text{min.}$ ); where, the point O(50, 250), point P(30, 140), point Q(10, 61), point R(0. 17), point S(0, 500) and point T(50, 500).

11. A p-type nitride semiconductor grown on a substrate at a temperature of 600°C or higher, wherein the hole carrier concentration immediately after the cooling equals to approximately 5% - 100% of the hole carrier concentration at said growth temperature.

12. A p-type nitride semiconductor grown on a substrate at a temperature of 600°C or higher, the upper surface of said p-type nitride semiconductor being exposed, wherein

the hydrogen concentration at the vicinity of upper surface of said p-type nitride semiconductor equals to 1 - 10 times that in the inside of said p-type nitride semiconductor.

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